SOME WETLAND DIPTERA OF A DISUSED BRICK-PIT

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Abstract. Diptera records were collated for several years of collecting at a disused brick-pit containing many temporary pools and a lake. The fauna included many uncommon species and a few coastal species whose presence is attributed to salinity from the clay. The numbers of Ephydridae and Dolichopodidae from areas with different hydrological characteristics are highest in areas of shallow pools and seasonal inundation and lowest at the shore of the lake. Species that are normally abundant in surrounding wetlands are scarce in the pit, suggesting that the low nutrient status of the water makes this site unusual in the nutrient-rich arable countryside of the Fens.

Introduction

It is becoming well established that shallow water, gently sloping margins and seasonally dry ponds are of great value to pond invertebrates; many water beetles, in particular, show a strong preference for temporary pools (Eyre *et al.* 1986, 1992; Bratton, 1990; Collinson *et al.* 1995). Little appears to have been published about the flies associated with this habitat, yet these insects may be particularly abundant around ponds and in wetlands (e.g. Blades & Marshall, 1994). Most of what has been published concerns aquatic families of flies, especially chironomids and ceratopogonids, but other wetland families contribute much to the species richness of the dipterous fauna of water margins (Batzer, *et al.*, 1999; Drake, in press).

This paper gives the results of casual investigations of the flies associated with water margins at a disused brick-pit. Although the work was not undertaken or structured with the intention of formal publication, it contributes towards our understanding of the richness of this fauna. Greater details are given for shore-flies (Ephydridae) whose habitats are poorly documented in the European literature but which are likely to show some clear associations with different features of wetlands.

Site description and methods

Dogsthorpe Star Pit is a disused brick-pit on the outskirts of Peterborough, Cambridgeshire (TF2002–2102). Two outstanding features of the site are the presence of seasonally flooded areas and small pools that dry out in summer, and a slight brackish influence, despite being about 20 miles from the nearest coastline. It was notified by English Nature as a Site of Special Scientific Interest (SSSI) in 1993 for its outstanding assemblage of invertebrates, principally water beetles. The site is now owned by the Wildlife Trust. Digging Oxford Clay for the brick industry from about 1899 until the 1950s left a long pit with an almost flat floor sloping gently downwards from west to east. Two new roads reduced its size to the present 36 ha. The pit would naturally fill with water had it not been pumped by its previous owners in expectation of its after-use as a landfill site. When the SSSI was notified the pit became worthless so regular pumping stopped in 1993, resulting in the deeper east end becoming a lake of about 10 ha from which drowned hawthorns still arise here and there. The lake obliterated a large number of the shallow pools which first drew the attention of entomologists to the site, including the cruciform pool that gave Star Pit its name. The rise in water level appeared to have slowed down in the late 1990s, helped in part by irregular pumping by the wildlife trust, so that, by 1999, the level fluctuated about 40 cm between high winter and low summer levels. Three of the four sides of the lake abut the pit's walls so that the shores here are steep-sided, leading directly to deep water fringed with dense reeds, rushes or wave-washed mud. The fourth, western shore has a very shallow gradient and merges with the drier part of the pit's floor. With the onset of autumn rain, an extensive area of perhaps 2 ha next to this shallow shore becomes a swamp with varied vegetation types interspersed with large expanses of open, shallow pools mostly up to about 20 cm deep and of widely varying extent. Later in the winter, the rising lake also inundates the swamp. By midsummer, the water dwindles to a few wet patches and occasional pools, and the shallow shoreline at the west end of the lake becomes a broad, sparsely vegetated, muddy margin. 1999 was one of the wettest years in the duration of this study but nevertheless nearly all the pools had dried out by late July; after heavy rain, most had refilled by late August and remained wet until the end of the year. A similar pattern of inundation and retreat has continued for several years, although the recent two wet winters of 2000 and 2001 have resulted in a higher water level throughout the system. Unauthorised motorbike scrambling appeared to be an important factor in maintaining water in some of the pools in the driest part of the year, as this activity deepened and 'puddled' the ruts, whereas the bare clay of undisturbed pools dried and cracked.

A patchwork of wetland plant communities has formed. Most pools and inundated areas which remain wet for much of the time are dominated by usually sparse *Juncus articulatus* and *Agrostis stolonifera* (occasionally dense but always very short) over almost bare clay, fringed with occasional or sometimes dense *J. inflexus*. In spring, *Ranunculus aquatilis*, *R. sceleratus* and *Chara* occupy the pools, followed in summer by an invasion of ruderal plants on the bare, often cracked clay. Stands of *Typha angustifolia*, *T. latifolia*, *Phragmites australis*, *Scirpus lacustris*, *S. tabernaemontani* and small patches of *Baldellia ranunculoides* and *Scirpus maritimus* make up the remaining wetland vegetation types. A few drainage ditches retain water throughout the year but, as most of them are choked and shaded by *Phragmites*, they support a species-poor aquatic flora.

The dry areas of the floor support a mix of vegetation types of which *Calamagrostis epigejos* over moss is the most prevalent. This also partly floods in winter. The steep sides of the pit are mostly either almost bare clay with sparse ruderal vegetation, hawthorn scrub or rank grassland on the new road embankments.

Measurements of conductivity made by John Bratton in 1989 suggested that there was a clear brackish influence, with readings between $2920 \mu S\,cm^{71}$ after heavy rain in May and $5460 \mu S\,cm^{71}$ after a dry spell in June that year; for comparison, local tap water has a conductivity well below $1000 \mu S\,cm^{71}$ and June value here represented approximately 6–8% sea water (value obtained by extrapolation of figure in Thomas *et al*, 1934). The chloride concentration measured by the National Rivers Authority in December 1992 was $90\,mg\,l^{-1}$, which represents almost insignificant salinity (less than 0.5% seawater), although still higher expected. It is likely, however, that sea salt is the cause of the brackishness, and not other ions such as leachate from the adjacent landfill site. The source remains unconfirmed but is most likely to be from weathering of the clay or possibly brackish water from the ancient aquifer in the limestone below the clay (Horton, 1989).

Star Pit is moderately isolated from other similar water bodies. Nearby wetlands where some of the species discussed here could have originated are sand and gravel pits within 1.5–2.5 km, other brickpits, both used and disused, at least 6 km away, and drainage ditches within the surrounding arable countryside.

Surveys in 1992–3 by several entomologists including myself, John Bratton, Roger Key, Peter Kirby and Alan Stubbs resulted in the first records of Diptera for the site. I later collected adult Diptera using a sweep net and, in May and June 1996, larvae using a pond net, kitchen sieve and direct observation. The intention was to collect as many species in the target groups as possible, so sampling was not standardised. Visits in 1999 were made at approximately monthly intervals from May to October each lasting about 3–4 hours. In 1993, 1996 and 1997 a broad spectrum of families was collected; in 1999 the only families to be collected thoroughly were Dolichopodidae, Sciomyzidae and Ephydridae, although other groups were also taken.

In 1999, the pit was divided into areas with contrasting characteristics but the seasonally changing water landscape made it difficult to stick to these – a swamp in May became discrete pools by June and damp mud by July, so sampling the flies associated with water margins had to be opportunistic. Samples were allocated to one of five areas:

1 Seasonal pools with short vegetation. Much of this area flooded as a swamp continuous with the rising lake from autumn to early spring, passing through a stage of discrete shallow pools in spring before almost completely drying out in midsummer. This cycle maintained a mosaic of heterogeneous but mainly short vegetation. Sampling included the edge of a long ditch with permanent water, although the difficulty of sweep-netting the reed-choked edge meant that it contributed few species to the collection.
2 Seasonal pools with tall emergent plants. These pools were fed by rainfall and perhaps inflow from surrounding land, including a weak seepage from a road embankment which never dried out completely; ochre and filamentous algae here suggested that it may have been connected to the adjacent landfill site or road drains. Most water lay under *Phragmites*, *Typha* spp, *Scirpus* spp or *Juncus inflexus*, often with a mossy understorey; most open pools here were kept bare by motorbikes scrambling. The elevation was higher than the swamp area so the lake did not flood these pools in 1998 or 1999.
3 Lake shore. Only one small but dipterologically productive stretch on an otherwise uninviting shore was sampled where a carpet of *Eleocharis acicularis*, sparse *Juncus articulatus* and occasional *Alisma plantago-aquatica* was inundated in winter and uncovered through much of the summer; mud was exposed when the lake was at its lowest in July and August.
4 Drawdown zone of the west shore of the lake. This was flooded for much of the year, but became swampy, patchy reedbed with small areas of *Eleocharis acicularis* and *Juncus articulatus*, and a broad muddy wave-washed margin up to about 20 m wide at the lake's lowest level.
5 Permanently water-filled ditch at the far west end. Only a small stretch could be swept because most of the ditch was choked by dense reeds.

Family accounts

The list of Diptera for Star Pit now stands at 255 species. These include 24 Empididae and Hybotidae, 35 Dolichopodidae, 36 Syrphidae, 13 Sciomyzidae, 14

Tephritidae and 44 Ephydridae. There are 17 nationally scarce species and one nationally rare species (RDB3), *Myopites inulaedyssentericae* Blot (national statuses from the biological recording package Recorder, as at December 1999). The wetland species among these are mentioned below; the remaining species are nearly all associated with the ruderal aspect of the site and were recorded in the early 1990s.

Dixidae. No attempt was made to collect these systematically. The coastal species *Dixella attica* (Pandazis) (RDB3) was found in 1993 and 1999, suggesting that it is resident.

Ceratopogonidae. The family was not systematically collected but one species, *Bezzia* (*Pygobezzia*) *atrata* Macfie, deserves mention; specimens were obtained on 1.vi.1996, and 29.v. and 25.iv.1999. The male genitalia agree completely with the drawings by Macfie (1944) and Clastrier (1962) of *B. atrata*, which Remm (1974) synonymised with *strobli* Kieffer but the taxonomy of the genus is sufficiently muddled to be unsure of the correct application. This species, whatever its name, is clearly an addition to the British fauna.

Stratiomyidae. Few species were found but they included *Stratiomys singularior* (Harris) which, although not invariably found at the coast, does have a strong association with brackish sites. In 1996, larvae were frequent at one moss-dominated *Typha* bed, which appears to be fed by the weak seepage, but they could not be found again in 1999. *Oxycera morrisii* Curtis was reared from larvae collected from moss-dominated pools, and those of *Oxycera trilineata* (L.) and *Oplodontha viridula* (Fab.) were also occasionally found. Adults of *Vanoyia tenuicornis* (Macquart) and *Nemotelus nigrinus* Fallén occurred rarely.

Empididae. *Hilara curtisi* Collin and *H. cornicula* Loew were collected sufficiently frequently during their short flight period to be sure that they breed on the site. *Hilara subpollinosa* Collin is a local species known to occur in ditch systems on grazing marshes, and its regular occurrence at Star Pit suggests that it breeds in this wetland too. *Dolichocephala irrorata* (Fallén) and *D. oblongoguttata* (Dale) were frequently found on bare wet mud, often but not always in the shade of tall monocotyledons.

Dolichopodidae. Most of the species recorded over the years were found again in 1999; the only species not re-recorded were *Dolichopus griseipennis* Stannius, *Chrysotus collini* Parent, *Schoenophilus versutus* (Haliday) and *Sciapus wiedemanni* (Fallén) (Table 1). The apparent absence of the last species is likely to be due to its grassland habitat not being searched. A total of 35 species is rather low for a well worked wetland site although it is similar to values obtained by a season's collecting with water traps in several semi-natural wetlands in Belgium (Pollet, 1992). Of the seven most abundant species, three are generally regarded as local in Britain. *Campsicnemus picticornis* and *Micromorphus albipes* were the most frequently caught species, occurring throughout the wet parts of the site, with captures each month from May to September in 1999, and *Syntormon pumilum* was collected frequently each month from May to August 1999. Four common species made up the remaining species frequently caught here: *Dolichopus nubilus*, *Rhaphium caliginosum*, *Syntormon pallipes* and *Sympycnus desoutteri*. It is noteworthy that common wetland species such as *Dolichopus ungulatus* (L.) and *Campsicnemus loripes* (Haliday) were absent

Table 1. Dolichopodidae and Ephydridae recorded in July 1997 and during 1999 at Star Pit. The values are the number of sampling sites where the species was recorded; the last column (Abundance) gives the product of the total number of locations6visits when the species was recorded (an approximate indication of frequency over the whole site). The column labels are the year, day and month. †confused with *graecula*.

	97 11 Jul	99 2 May	99 29 May	99 25 Jun	99 27 Jul	99 22 Aug	99 22–5 Sep	99 26 Oct	Abundance
Achalcus cinereus (Haliday in Walker)	1	–	–	–	–	–	–	–	1
Argyra argyria (Meig.)	–	1	–	–	–	–	–	–	1
Campsicnemus curvipes (Fallén)	–	–	1	3	1	–	3	2	10
Campsicnemus picticornis (Zett.)	–	–	2	4	3	3	2	–	15
Campsicnemus scambus (Fallén)	–	–	–	–	–	–	–	1	2
Chrysotus palustris Verrall	–	–	1	1	–	–	–	–	2
Chrysotus suavis Loew	–	–	2	–	–	–	–	–	2
Dolichopus campestris Meig.	–	–	–	1	–	–	–	–	1
Dolichopus festivus Haliday	–	–	–	–	1	–	–	–	1
Dolichopus latelimbatus Macquart	–	–	–	–	–	–	1	–	1
Dolichopus nubilus Meig.	1	–	1	2	–	1	–	–	6
Dolichopus plumipes (Scop.)	–	–	1	1	–	–	–	–	2
Dolichopus signifer Haliday	–	–	1	–	–	–	–	–	1
Hydrophorus bipunctatus (Lehmann)	–	–	–	–	–	–	–	1	1
Hydrophorus litoreus (Fallén)	–	–	–	1	–	–	–	1	2
Hydrophorus praecox (Lehmann)	–	–	–	–	1	–	1	–	3
Liancalus virens (Scop.)	–	–	–	–	–	1	–	–	1
Medetera saxatilis Collin	–	–	1	–	–	–	–	–	1
Medetera truncorum Meig.	1	–	–	–	–	–	–	–	1
Micromorphus albipes (Zett.)	1	1	2	3	–	2	2	–	12
Poecilobothrus nobilitatus (L.)	–	–	–	1	–	–	–	–	1
Rhaphium caliginosum Meig.	1	1	–	2	–	–	1	–	5
Rhaphium laticorne (Fallén)	–	1	1	1	–	–	–	–	3
Scellus notatus (Fab.)	–	–	1	–	–	–	–	–	1

continued

Table 1. continued

	97 11 Jul	99 2 May	99 29 May	99 25 Jun	99 27 Jul	99 22 Aug	99 22–5 Sep	99 26 Oct	Abundance
Sympycnus desoutteri Parent	–	2	1	1	1	2	3	–	10
Syntormon denticulatum (Zett.)	1	–	1	1	–	1	–	–	4
Syntormon pallipes (Fab.)	–	2	1	–	1	2	4	2	16
Syntormon pumilum (Meig.)	1	–	2	4	1	1	–	–	9
Teuchophorus spinigerellus (Zett.)	1	–	–	1	–	–	–	–	2
Thrypticus bellus Loew	–	–	1	–	–	–	–	–	1
Thrypticus nigricauda Wood	–	–	–	1	–	–	–	–	1
total dolichopodids	7	7	16	16	7	8	8	5	31*
Axysta cesta (Haliday)	–	1	1	1	–	1	2	–	6
Coenia curvicauda (Meig.)	–	1	–	–	–	–	–	–	1
Coenia palustris (Fallén)	–	–	1	–	–	–	2	–	3
Discocerina obscurella (Fallén)	–	–	–	2	–	–	–	–	2
Ditrichophora plumosa (Fallén)	–	1	–	–	–	–	–	–	1
Ephydra riparia Fallén	–	–	–	–	–	–	2	1	3
Hyadina guttata (Fallén)	–	–	1	–	–	–	–	–	1
Hyadina humeralis Becker	1	–	–	1	–	1	–	–	3
Hyadina rufipes (Meig.)	–	–	–	–	–	–	1	–	1
Hydrellia albilabris (Meig.)	–	–	–	–	–	1	1	–	2
Hydrellia argyrogenis Becker	–	1	–	–	1	–	4	–	6
Hydrellia cardamines Haliday	–	–	2	2	1	2	2	–	9
Hydrellia cochleariae Haliday	–	–	–	1	1	–	–	–	2
Hydrellia fascitibia (von Roser)	–	–	–	–	–	2	–	2	4
Hydrellia griseola (Fallén)	–	1	2	3	–	1	6	3	18
Hydrellia maculiventris Becker	–	–	–	–	–	–	1	–	1
Hydrellia maura Meig.	–	1	2	2	3	3	4	2	18
Hydrellia nigricans (Stenhammar)	–	2	2	4	1	3	3	–	15
Hydrellia obscura (Meig.)	–	–	1	1	–	1	–	–	3

Hydrellia porphyrops Haliday	–	–	–	–	–	1	1	–	2
Notiphila cinerea Fallén	1	–	2	3	3	3	2	–	14
Notiphila dorsata Stenhammar	1	–	–	1	1	–	–	–	3
Notiphila graecula Becker	1	–	2	3	2	3	3	–	14
Notiphila nigricornis Stenhammar	1	–	–	1	–	–	–	–	2
Notiphila nubila Dahl†	1	–	–	1	–	–	–	–	2
Notiphila riparia Meig.	1	–	–	–	1	1	–	–	3
Notiphila venusta Loew	1	–	–	1	–	–	–	–	2
Paracoenia fumosa (Stenhammar)	–	–	–	–	–	–	1	–	1
Parydra aquila (Fallén)	1	–	–	–	–	1	2	1	5
Parydra coarctata (Fallén)	–	1	2	2	2	3	5	1	17
Parydra fossarum (Haliday)	–	3	2	3	3	3	6	2	23
Parydra pusilla (Meig.)	–	–	–	–	–	1	–	–	1
Pelina nitens Loew	1	–	–	–	–	–	–	–	1
Pelina similis Papp	–	–	–	1	–	–	–	–	1
Psilopa nigritella Stenhammar	–	–	1	2	1	1	–	–	5
Scatella lutosa (Haliday)	–	–	–	1	–	–	–	–	1
Scatella paludum (Meig.)	–	1	2	1	1	2	1	–	8
Scatella silacea Loew	–	–	–	–	–	–	1	–	1
Scatella stagnalis (Fallén)	1	–	1	2	1	–	3	–	8
Scatella tenuicosta Collin	1	2	–	3	1	3	4	1	17
Scatophila ?noctula (Meig.)	–	1	–	–	–	–	–	–	1
Setacera aurata (Stenhammar)	–	–	–	–	–	–	1	–	1
Setacera micans (Haliday)	–	–	–	–	–	–	–	1	1
Setacera trina Collin	–	–	–	–	–	–	–	1	1
total ephydrids	12	12	15	23	15	20	23	10	44

**Chrysotus collini* Parent, *Dolichopus griseipennis* Stannius, *Schoenophilus versutus* (Haliday) and *Sciapus wiedemanni* (Fallén) were recorded in earlier years.

and other normally ubiquitous species such as *Poecilobothrus nobilitatus* and *Dolichopus plumipes* were infrequent.

There was one coastal species, *Dolichopus signifer*, which is almost entirely restricted to coastal sites (Fonseca, 1978; Falk & Crossley, in prep.). Males were collected in June 1993 and late May 1999, suggesting that there is a resident population. Other species often recorded in coastal habitats, though not confined to these, are *Schoenophilus versutus* and *Dolichopus nubilus* (Emeis, 1964). Local species that were occasionally collected were *Dolichopus campestris*, *Rhaphium laticorne*, *Scellus notatus*, *Thrypticus nigricauda* and *Chrysotus suavis*, the last not being necessarily associated with wetlands.

Syrphidae. I did not collect the group assiduously but Alan Stubbs recorded many in 1993. Some less common wetland species included *Platycheirus fulviventris* (Macquart), *Neoascia interrupta* (Meig.) and *Anasimyia contracta* Claussen & Torp, the last two having been first found in 1993 as well as more recently, and thus suggesting resident populations. *Parhelophilus versicolor* (Fab.) was recorded in 1993.

Sciomyzidae. The group as a whole is poorly represented, with only 13 species being recorded. The most frequently found wetland species in 1999 were *Colobaea punctata* (Lundbeck) and *Pherbellia nana* (Fallén) which, although regarded as nationally scarce, were widespread and locally numerous each month from 29.v.–25.ix.1999. The frequent occurrence of *P. nana* at Star Pit concurs with Falk's (1991) suggestion that it may prefer pools and ditches that dry out in summer and have sparse emergent *Phragmites*. Other than the terrestrial *Pherbellia cinerella* (Fallén), the remaining sciomyzids were infrequently recorded. *Colobaea bifasciella* (Fallén) is the only nationally scarce one among these, collected on 2.v.1999. A shortage of aquatic snails may be a reason for the limited fauna since, of the ten species recorded, only *Lymnaea peregra* (Müller) and *L. truncatula* (Müller) were frequent in the seasonal pools. *Pherbellia nana* attacks hygrophilous snails, so may not be confined to these aquatic species (Knutson, 1970).

Sepsidae. Four species of *Themira*, including *T. superba* (Haliday), were recorded. Their larvae develop in dung-enriched muddy water margins (Pont, 1979), and there was certainly plenty of bird dung on the lake shore, resulting mainly from roosting black-headed gulls attracted to the adjacent landfill site. *Themira* species were infrequent away from this nutrient-rich shore.

Anthomyzidae. This family was not systematically collected. Two conspicuous uncommon members are *Typhamyza bifasciata* (Wood) (11.vii.1997) and *Anagnota bicolor* (Meig.) (2.v.1999). *Typha angustifolia* is regarded as the host plant of *T. bifasciata* and although the plant occurs here it is hardly abundant. There is no *Carex paniculata* which Falk & Ismay (in prep.) suggested is a possible host plant of *A. bicolor*, whereas cigar galls formed by the chloropid *Lipara lucens* Meig. on *Phragmites* are a common sight here, and these are a more probable larval site of *A. bicolor*. *Anthomyza collini* Andersson and *A. gracilis* Fallén were the common species, as expected at a site with plenty of reed.

Ephydridae. Considerable effort was taken recording this family, especially in 1999. Some species were the commonest flies on the water margins, along with Sphaeroceridae which were not investigated. All 44 species recorded over the years were found in 1999 (Table 1). This represents about a quarter of the British shore-fly fauna (Chandler, 1998), and about one-third of the freshwater species (of those found, only species of *Hyadina* may not be closely tied to freshwater habitats, although the literature is ambiguous, e.g. Dahl, 1959 and Clausen, 1983). Although nearly all species were recorded at least once in the area of the most extensive and varied shallow pools, nine were infrequent or absent here. The scarcity of information on the distribution of most ephydrids makes it difficult to assess their rarity status but those at Star Pit that I regard as uncommon nationally are *Axysta cesta*, *Hydrellia fascitibia*, *H. porphyrops*, *Notiphila venusta*, *Parydra pusilla*, *Scatella silacea* and *Scatophila noctula*.

The genera *Hydrellia* and *Notiphila* were well represented. Most species of *Notiphila* were restricted to the midsummer months, and only the ubiquitous *N. cinerea* and *N. graecula* occurred into late September. The normally common *N. riparia* was scarce. As might be expected of species whose larvae are fully aquatic, the adults were nearly always found very close to the more permanent water such as within the reedbeds along the lake shore and ditches. Few *Notiphila* were found by the seasonal pools, and they never reached the abundance found in the dense beds of emergent vegetation in ditches and river margins of the surrounding countryside. *Notiphila nubila* is probably fairly widespread, although not common, in southern Britain (Drake, 2001) and was confused with *graecula* during the study so it is not possible to give precise information on its habitat or flight period at Star Pit. Dates of vouchers kept are 5.vi.1993, 11.vii.1997 and 25.vi.1999; *graecula* was also present on the same dates in 1993 and 1997.

Britain's commonest species of *Hydrellia*, *maura* and *griseola*, were found throughout the sampling period from 2.v. to 26.x, although *nigricans* and *cardamines* were also frequently recorded for much of the year and at a variety of pools; *cardamines* was sometimes the most abundant *Hydrellia*. *H. argyrogenis* also had a long flight period but was found only in low numbers. Although relatively few specimens of some other species were found, the dates suggest that *H. cochleariae* and *H. obscura* fly in early summer and *H. fascitibia*, *H. maculiventris* and *H. porphyrops* fly later. The infrequent collection of some *Hydrellia* is probably a consequence of their flying low when disturbed, which enables them to evade sweep netting. For instance, when *H. argyrogenis* was disturbed it flew only just above the water to the nearest piece of floating vegetation and clearly avoided the mud margin. The low occurrence of the common *H. albilabris* is probably related to the scarcity of floating duckweed (*Lemna*) in which the larvae feed, although the fly has been found in abundance at a pool devoid of *Lemna* on another nearby site (Castor Hanglands NNR). At the lake shore (area 3), *H. cardamines* and *H. nigricans* were numerous (*Juncus articulatus*, which was frequent at this site, is a host plant of *nigricans* (Mathis & Zatwarnicki, 1995)), and it was the only site where a few specimens of *H. maculiventris* were found.

Only a few, mainly common species of *Parydra* were recognised and, as is typical of the genus, they were most numerous on bare mud. *P. aquila* was found on several occasions only at the muddy receding shore of the lake and at a nearby mud patch. Its confined distribution may have been related to the high organic content of this mud where bird droppings were abundant. *P. pusilla* was found only once, which was surprising in view of its frequency at another nearby disused brickpit (Drake, 1999). Another genus whose distribution and abundance may be constrained by the organic content of the mud is *Scatella*, of which no species was numerous. The only locally abundant species was *S. paludum* on the receding muddy lake shore with bird droppings. *S. lutosa* is usually found on coastal sites.

Two species were most frequently found in early summer. *Psilopa nigritella* was locally frequent for a short period in June. *Axysta cesta*, while most frequent in spring and early summer, continued to be found until 25 September, and is clearly not a 'spring' species as suggested by Dahl (1959). It was almost restricted to the lake shore and nearby flooded areas, and was most frequent, although never numerous, in the *Eleocharis acicularis* lawn on the lake shore.

Larger species of ephydrids, including all three British *Setacera*, *Ephydra riparia* and *Paracoenia fumosa*, were found only late in the year. As usual with *Ephydra* and *Setacera*, they were found on the surface of pools with a broad (c. 1 m) expanse of open water uninterrupted by vegetation, and this probably limited their occurrence to recently flooded, sparsely vegetated ground.

Species that were rarely recorded included three species of *Hyadina*, two *Pelina*, both *Coenia*, *Ditrichophora plumosa* and the normally frequent *Discocerina obscurella*.

The opportunity is taken to illustrate the genitalia of male *Hydrellia nigricans* (Fig. 1), which was one of several species not figured by Collin (1966), and which was inadvertently omitted from Chandler (1998) and not included as British in Mathis & Zatwarnicki (1995). It is a common and widespread species in southern Britain.

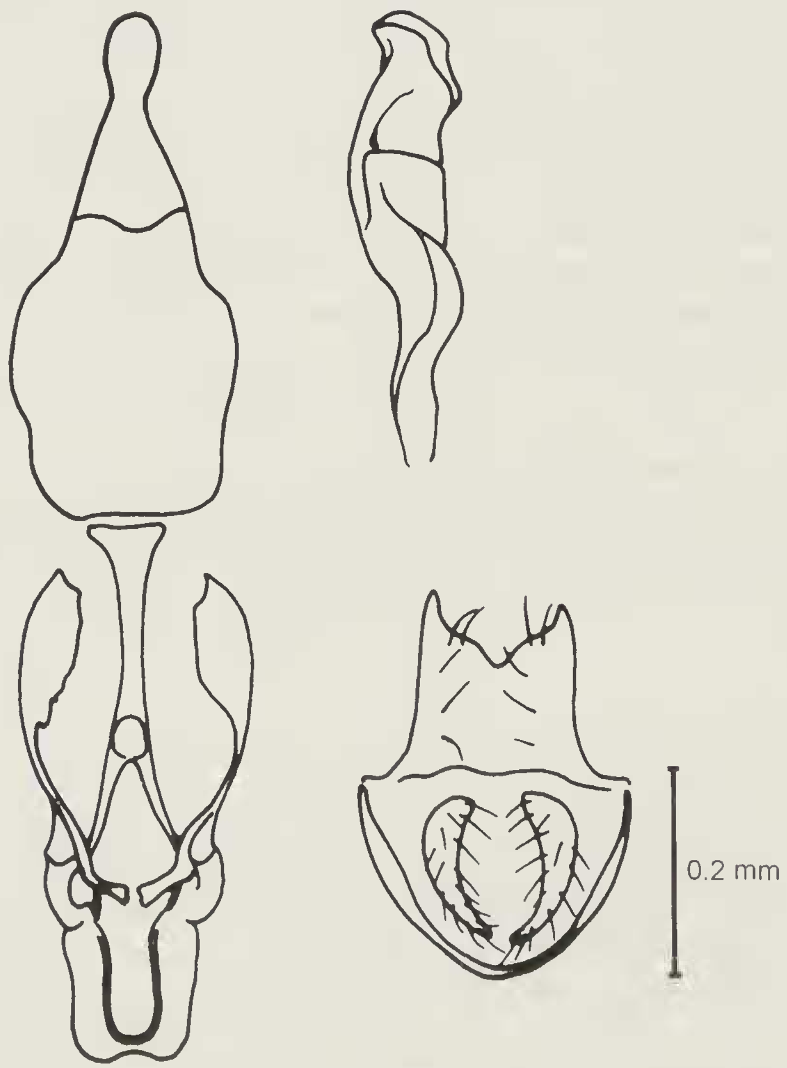

Figure 1. Genitalia of male *Hydrellia nigricans*. Left: internal appendages and aedeagus (uppermost). Right above: aedeagus in lateral view. Right below: epandrium. Scale line represents 0.2 mm.

Diastatidae. *Diastata adusta* Meig. was a widespread and numerous species on the site from 2.v. to 26.x.1999. It is frequently encountered in wetlands (Chandler, 1986).

Habitat associations for samples collected in 1999

The number of species of dolichopodids, ephydrids and sciomyzids using each of the five characterised types of wetland show that most were recorded in the better-worked area of seasonal pools and inundation, but no area could be considered devoid of interest for at least one of the families (Table 2). Several samples from around the lake shore at unproductive points have been omitted since the effort spent here was low. The species richness of dolichopodids and ephydrids was considerably higher in the more sparsely vegetated seasonal pools (first column of Table 2) compared with that in the seasonal pools with taller vegetation and the productive stretch of lake shore (all three areas having been sampled with similar intensity).

Species were ordered by eye into groups that may reflect preferences for different habitat types. The following suggestions are made for the more frequently occurring species, but must be taken cautiously and should not be assumed to be universally true. Inclusion in a group was based on a species distribution and its abundance, so that even though a species may have been found over the whole site, it was allocated to one habitat group if it was particularly abundant there. Some species fall into more than one category.

showing no affinities: *Sympycnus desoutteri*, *Syntormon pallipes*, *Scatella tenuicosta*, *Hydrellia argyrogenis*, *H. griseola*, *H. maura*, *H. nigricans*, *Notiphila cinerea*, *N. graecula*, *Parydra coarctata*, *P. fossarum*.

favoured by seasonal pools with open, sparse vegetation: *Campsicnemus curvipes*, *C.picticornis*, *C. scambus*, *Dolichopus nubilus*, *Hydrophorus praecox*, *Micromorphus albipes*, *Rhaphium caliginosum*, *Syntormon pumilum*, *Pherbellia nana*, *Colobaea punctata*, *Ephydra riparia*, *Psilopa nigritella*, *Scatella stagnalis*.

favoured by densely vegetated seasonal pools: *Campsicnemus curvipes*, *C. picticornis*, *Micromorphus albipes*, *Rhaphium caliginosum*, *Syntormon pumilum*, *Pherbellia nana*, *Colobaea punctata*.

dependent upon proximity to nearly permanent water: *Syntormon denticulatum*, *Rhaphium laticorne*, *Axysta cesta*, *Hydrellia cardamines*, *Notiphila dorsata*, *N. riparia*.

Table 2. Number of species of Dolichopodidae, Ephydridae and Sciomyzidae recorded in different wetland types (described in the methods) in 1999.

	seasonal pools with short vegetation	seasonal pools with tall vegetation	permanent (but productive) lake shore	drawdown zone of lake	ditch with permanent water
Dolichopodidae	24	14	11	6	1
Ephydridae	33	21	20	20	10
Sciomyzidae	6	6	3	3	0
Number of samples taken	8	7	7	4	1

dependent upon nutrient-enriched mud: *Scatella paludum*, *S. tenuicosta*, *Parydra aquila*.

Discussion

Star Pit SSSI was notified primarily for its assemblage of water beetles. This review of the Diptera shows that they too are an important component of the wetland fauna. The species composition differed conspicuously from rich fenland sites, for example the complete absence of *Hercostomus* and infrequent occurrence of *Dolichopus* which is usually speciose in British fenlands, and which together made up a far larger proportion of the total species recorded in a Flemish wetland on clay (Pollet & Decleer, 1989). The far-from-lush vegetation and stunted growth of *Phragmites*, *Scirpus lacustris* and *Typha* pointed to a low nutrient status of the water in the pools. Apart from one tiny seepage and perhaps slow feed from ground-water into the permanent ditch, there is no obvious input of water other than rainfall. The lake, in contrast, is likely to be in the process of becoming nutrient-enriched as a result of the large population of roosting gulls that feed on the adjacent landfill site. The low nutrient status of the pools is reflected in the absence or scarcity of a number of flies that are commonly found in lowland wetlands, pond margins and ditches, for example *Dolichopus ungulatus*, *D. plumipes*, *Notiphila riparia*, *Scatella stagnalis* and *S. tenuicosta*. Flies such as *Scatella paludum* and *Parydra aquila* that are usually associated with organically enriched habitats were present only on or near the lake shore where bird droppings were frequent. Those associated with accumulations of leaf litter, such as *Coenia palustris* and *Discocerina obscurella*, were also disadvantaged by the low amounts of organic matter (Foote, 1990; Foote & Eastin, 1974). Star Pit is thus an unusual water body in an arable countryside setting where high inputs of fertiliser and naturally eutrophic aquatic conditions are the norm.

The dipterous fauna of Star Pit appeared to differ from that of Orton Pit SSSI, another nearby brick-pit but with clear differences in the physical structure, hydrology and vegetation. Here the rare fenland species *Ochthera manicata* (Fab.) and *Thrypticus cuneatus* (Becker) were recorded, and *Parydra pusilla*, found only once at Star Pit, was rather more numerous (Drake, 1999).

The brackish element seen in the water beetle fauna of Star Pit was not so marked among the flies. Species in this group were *Dixella attica*, *Dolichopus signifer*, *Stratiomys singularior* and possibly *Schoenophilus versutus*, *Dolichopus nubilus*, *Ephydra riparia* and *Scatella lutosa*, although the last five are known from entirely freshwater inland sites. It is noteworthy that the slow filling-up of the pit has not eliminated this interesting component of the fauna.

The more detailed study in 1999 has shown that shallow seasonally inundated pools can be a valuable habitat for some groups of wetland Diptera. By comparison with the lake shore and reed-choked ditches, the richest sites were the seasonal pools and swamp, especially those where annual inundation and retreat kept the vegetation sparse and prevented tall monocotyledons from establishing large stands. The composition of the dolichopodids shows a strong similarity with the group of mainly ground-dwelling species favouring unshaded humid conditions recorded by Pollet & Grootaert (1987). It is almost certain that the extensive water margin and wet shores presented by numerous pools is the breeding site for many of these dolichopodids and other flies found most often in the short vegetation that characterises the seasonal pools. Four nationally scarce or local species that were particularly frequent at Star Pit, *Pherbellia nana*, *Colobaea punctata*, *Campsicnemus picticornis* and *Micromorphus albipes*, are thought to be outstanding beneficiaries of the seasonal nature of the pools.

An aspect of these pools that contributes to their importance for wetland Diptera is the exposure of bare sediment, which is nearly always clay at Star Pit; Scheiring & Foote (1973) found that the mud-shore habitat supported more species of ephydrids than any other of nine freshwater habitats that they studied. This is in part due to the unshaded, nutrient-washed substrate supporting the micro-organisms—diatoms, bacteria and blue-green algae—that form the food of many shore flies, which in turn are probably among the prey of dolichopodid larvae (Thier & Foote, 1980; Zack, 1983). The instability and temporary nature of this habitat, coupled with its rapid regenerative ability, are essential features that make this habitat more attractive to some Diptera compared with the permanent, even if fluctuating shoreline of the lake (Dahl, 1959; Thier & Foote, 1980). The lake shore at Star Pit, apart from, tiny sheltered stretch vegetated with short *Eleocharis*, was steep-sided and was either dominated by reed standing in the water or was nearly bare and wave-washed, thus making it uninhabitable for most dipteran larvae adapted to water margins. Even the broad muddy western shore exposed by summer drawdown supported relatively few species. Steinly (1986) also concluded that wave-washed shores were poor habitat for ephydrids compared to sheltered shorelines with shallow water.

Seasonal pools are probably not the habitat of some species since complete drying-out probably leads to their local extinction. Many ephydrids, for instance, were noticeably scarce in the pronounced drying-out in July 1999 and could be found only close to water, even if only tiny pools such as wheel ruts, and the total number of species recorded was noticeably lower than in the preceding and following months (Table 1). Species of *Parydra* became conspicuously infrequent away from the vicinity of the lake after July, and the additional bare mud where they are so often found did not compensate for possible death of the semi-aquatic larvae. Fewer species of dolichopodids were found than were expected in a wetland, and this may reflect excessive drying-up of their larval sites, especially as it seems that some larger species (although not small ones) are probably univoltine (Meuffels *et al.*, 1989) and thus lack the opportunity to invade pools during their wet phase.

These results were based on unstructured sampling and are no more than indications of the high value of seasonal wetlands to these flies. The association of ephydrids with variations on the wetland theme failed to show as much as had been hoped. It is clear that detailed sampling, perhaps using emergence traps to pinpoint the larval breeding sites, is needed to confirm the suspicion that seasonal wetlands and fluctuating water levels are of particular importance to Diptera.

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SHORT COMMUNICATIONS

***Cecidostiba fungosa* (Geoffroy) (Hymenoptera: Pteromalidae). A new association with the agamic generation of *Andricus quercuscalicis* (Burgsdorf) (Hymenoptera: Cynipidae) in Britain.**—The "knopper" galls of *Andricus quercuscalicis* (Burgsdorf) are common on the continent and in Britain but were not recorded in this country until first found by Claridge (1962). Several studies have followed the changes in parasitoid guilds associated with this species in Britain and across mainland Europe. Hails *et al.* (1990) found very low frequencies of parasitism in British galls and the detailed studies of Schönrogge *et al.* (1995) still found differences between the British and mainland European guilds. One of the species frequently associated with *A. quercuscalicis* on the continent but not in Britain was *Cecidostiba fungosa* (Geoffrey) (=*hilaris* (Walker)). (In 1961 R. R. Askew described *C. adana* from French galls of *A. quercuscalicis* but he is now of the opinion that *adana* is a junior synonym of *fungosa*. (R. R. Askew, *pers. comm.*).)

On 10.xi.98 the author collected "knopper" galls from Kent, Shorne, TQ6770 and these were overwintered in an outside building. One female *C. fungosa* emerged on 15.iv.1999 and another female on 17.iv.1999. Another collection of galls from Kent, High Halstow, TQ7776 on 19.x.1998 produced five males and three females in iv.1999. *C. fungosa* is a frequent parasitoid associated with the oak apple galls of *Biorhiza pallida* (Olivier) but the above are the first British records of an association with *A. quercuscalicis*.

Schönrogge *et al.* (1995) showed that *C. fungosa* does not attack the larvae of *A. quercuscalicis* but rather is a parasitoid of the inquiline cynipids *Synergus gallaepomiformis* (Boyer de Fonscolombe) and *S. umbraculus* (Olivier) found in knopper galls. Neither the presence of the inquilines nor that of *C. fungosa* is generally fatal to *A. quercuscalicis*. Both of the inquiline species are frequent in other oak galls in Britain but are rather scarce from *A. quercuscalicis*. It is noteworthy that from the Shorne collection of galls one male *S. gallaepomiformis* emerged 2.vi.1999.

I would like to thank R. R. Askew for confirming the identity of *C. fungosa* and for help with the nomenclature.—MALCOLM JENNINGS, 206 Lower Higham Road, Gravesend, Kent DA12 2NN.

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